

## THE NUT WEEVILS.

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### INTRODUCTION.

Nut-growing in the United States would be a much more profitable industry were it not for the insects which inhabit the kernels, rendering them unfit for food. This is especially true of the chestnut and chinquapin and to a lesser extent of pecan, hickory, and hazel nuts; while others, which include butternuts, walnuts, and almonds, suffer little or no injury from this source. Considerable diminution in the yield of many forms of nuts is also caused by the inroads of insect larvæ in the growing husks. Examples of the first class are the chestnut "worms" or weevils; of the second, the husk-worms and walnut curculio. The present paper will be restricted to a consideration of the weevils.

The chestnut crop suffers the greatest loss, and the chief depredators are the grub-like "worms" or larvæ with which everyone is too distressingly familiar. These larvæ develop with the nuts, so that those which first attain maturity are ready to leave and enter the ground nearly as soon as the nuts

are gathered; others remain in the nuts some weeks later; so it frequently happens that when nuts are packed for shipment in bags or barrels, some nuts which were apparently sound when shipped are found, on reaching their destination, with one or more holes in their shells (fig. 17), while the repulsive grubs crawl about at the bottom of the receptacle. How to cope with these weevils has long been a most vexatious problem.

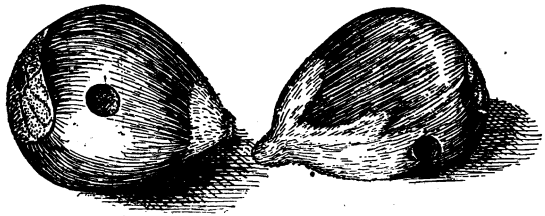


FIG. 17.—Chestnuts showing exit holes of chestnut weevil larvæ—enlarged one-fourth (author's illustration).

### THE CHESTNUT WEEVILS.

In comparatively recent years chestnut culture has assumed considerable proportions, and has taken a new impetus since the extensive introduction and development of Japanese and European varieties. These are grafted on American seedlings or native stocks, and thus many valueless trees on equally unpromising soil are converted into

sources of profit. Were it not for the "worms," borers, and "blights," chestnut growing might develop into a most lucrative industry in regions adapted to it.

ESTIMATES OF LOSSES.—A fair estimate of the damage done annually by weevils to chestnuts grown in the United States would probably fall little short of 25 per cent, while in some years the percentage exceeds that figure, running as high as 40 or 50 per cent. Growers in some localities report no damage, others place losses as low as 5 or 10 per cent, while instances are cited of whole crops being destroyed. The amount of loss is dependent on locality, season, and to a more limited extent on the variety of nuts grown. The greatest damage is usually incurred in regions where chestnuts have grown wild for many years, and the least where there are no wild chestnuts or chinquapins and the nuts are grown only for market and are carefully gathered. The most extensive losses, judging from available sources of information, appear to be in Massachusetts, Pennsylvania, New Jersey, New York (in the vicinity of New York City), Delaware, Maryland, Virginia, Tennessee, and North Carolina.

In Georgia, Spanish and Japanese varieties have been cultivated for years without attack by weevils being noticed. In New Jersey, 50 per cent of the same varieties have been ruined. A grower in Missouri has reported no damage to 50 trees of an American variety; another at South Haven, Mich., has reported no injury for a period of three or four years to Japanese and Spanish chestnuts grown there, while from 5 to 20 per cent of the crop of native nuts was annually destroyed. The nearly complete destruction of the chestnut crop of New Jersey for 1893 was reported.

THE SPECIES OF CHESTNUT WEEVILS.—The species of weevils which infest chestnuts are two in number—the larger chestnut weevil, *Balaninus proboscideus* Fab., and the lesser chestnut weevil, *B. rectus* Say. They have extremely long, slender beaks or snouts, nearly as fine as a horsehair, and considerably longer than the body in the female. By means of this long beak the female is able to penetrate the thickest burr of the chestnut with its long spines and to cut out, with the minute and sharp mandibles at the tip of her beak, a little hole for the deposition of her eggs. These are inserted through the husk into the growing nut.

The two species resemble each other greatly in color and in markings, the general color of both being golden yellow, ochraceous or clay yellow, frequently tinged with olive, and a little paler on the lower surface. The disk of the thorax is a little darker, with a wide bright band on each side, and the elytra, or wing-covers, are mottled with rich light brown or dark brown markings of variable size and extent.<sup>a</sup>

<sup>a</sup> Occasional individuals lack the darker markings, some being paler, others darker, even reddish. The ground color, as may be seen in abraded specimens, is really black, and the apparent color is due to scales very similar to those of butterflies and moths.

## THE LARGER CHESTNUT WEEVIL.

*(Balaninus proboscideus* Fab.)

The larger chestnut weevil (fig. 18) is considerably the larger and more robust species. The female rostrum or beak, although proportionately of about the same length as in the lesser weevil, is perceptibly more prominent because less curved, the curvature being toward the tip. It is also more widened at the base. The body measures from one-third to nearly one-half of an inch in length, and the beak of the female is often five-eighths of an inch long. That of the male (fig. 18, *c*) is nearly as long as the elytra. The egg is small, about one-sixteenth of an inch long, and of the outline shown in figure 19, *d*. It is nearly white, partially translucent, and without sculpture.

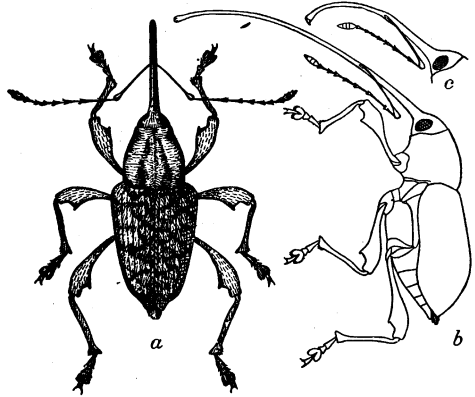


FIG. 18.—The larger chestnut weevil (*Balaninus proboscideus*): *a*, female beetle; *b*, same in outline from side; *c*, head, rostrum, and antenna of male—three times natural size (original).

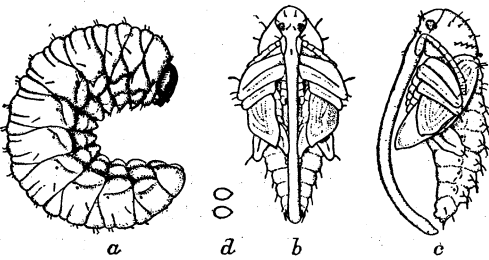


FIG. 19.—Larger chestnut weevil (*Balaninus proboscideus*): *a*, larva; *b*, *c*, female pupa; *d*, eggs—all enlarged (original).

The larva (fig. 19, *a*) is milk-white, robust, fully three times as long as wide, with the dorsal or upper portion rounded and convex. The entire surface is very strongly wrinkled transversely, and there are a few very short hairs scattered sparsely over the different segments. The head (fig. 20) is about one-fourth as wide as the widest portion of the body. It is provided with short but strong mandibles, by means of which it gnaws the kernel constituting its food. The fully developed larva in ordinary resting position measures nearly half an inch. Although the larva has no true legs, it is able to crawl, slowly and clumsily, it is true, by means of the flattened lower surface, locomotion being aided by transverse wrinkles.

The pupa is of a clearer whitish color than the larva, and shows the principal external organs of the body of the future beetle, all, except the beak, folded tightly to the body. The female pupa is illustrated in figure 19, *b*, *c*.



FIG. 20.—*Balaninus proboscideus*: head—much enlarged (author's illustration).

This species, like the other weevils under consideration, is native to America and is known from Rhode Island to Virginia, the District of Columbia, southern Ohio, and Tennessee, and westward to Kansas. The geographical distribution of this and the other nut weevils has as yet not been carefully studied, but in all probability it is considerably more extensive than above stated.

In some regions this species is quite generally known as the chinquapin weevil, but the investigations conducted during 1904 indicate that, although it breeds in chinquapins and more commonly in chestnuts, it occurs in greater abundance in the larger imported nuts.

#### THE LESSER CHESTNUT WEEVIL.

(*Balaninus rectus* Say.)

The lesser chestnut weevil (fig. 21) has the scape of the antenna longer than in the preceding species and the first joint longer than the second.<sup>a</sup> The average length of the body is about one-fourth of an inch, but the size varies, as in all of these insects.

The distribution of this species extends from Canada and Massachusetts to North Carolina, Tennessee, and Ohio, and probably farther westward. The writer has seen sets of specimens labeled "Arizona." Although in some localities the larger species is much more in evidence, taken all in all, the lesser weevil is the more com-

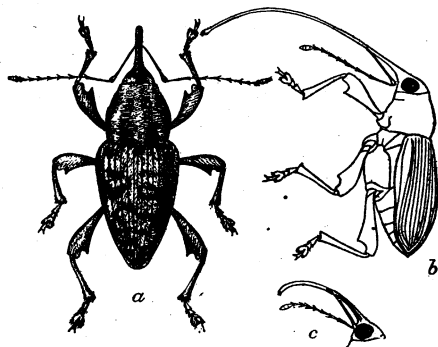


FIG. 21.—Lesser chestnut weevil (*Balaninus rectus*), adult: a, female, dorsal view; b, female, lateral view; c, head of male—much enlarged (author's illustration).

mon and is probably even more widely disseminated.

The egg has not come under observation, but is undoubtedly very similar to that of the preceding, being proportionately smaller, which is true of the remaining stages.

The larva is only a third of an inch long and its length is about three times its width. The body is milk-white and the head light brownish yellow, while the  $\Delta$ -mark has a short lateral branch each side.

The pupa differs from that of the larger species by size and by characters shown in figure 22, which illustrates the male.

<sup>a</sup> In the larger species the first joint (omitting the scape) is shorter than the second. In the female *rectus* the rostrum is strongly curved, the thorax is longer than wide, and the elytra are strongly acuminate apically. The tooth with which the thighs are armed is small, with the entering angle rounded.

## LIFE HISTORY OF BOTH SPECIES.

The life history of our two chestnut weevils is so similar as to be practically the same for both species. There are, however, minor differences. These, as well as related nut and acorn weevils, hibernate exclusively in the larval condition and in the soil. Both make their first appearance at about the same time—with the first blooming of chestnuts—but this period may vary from late in June to July, according to locality and season, or, more properly speaking, the mean temperature. At this time the beetles are found rarely and scatteringly, and as oviposition has not been observed then it is doubtful whether it begins until considerably later. What function these early arrivals fulfill is problematical. The beetles increase in number as the nuts approach maturity, or until about the middle of September or a little time before the nuts are first marketed. Then they may be seen in greater abundance, several pairs, frequently of both species, often occurring on a single bunch of burrs (Pl. XXVIII). As it requires about two weeks for the egg to develop, it is not probable that they are laid much earlier than when the nut begins to form. From examination of many burrs gathered in the fall of 1904 by Mr. F. C. Pratt, of the Bureau of Entomology, who visited some of the principal chestnut groves of Pennsylvania and Virginia at the urgent request of growers in those States, it is deduced that the first eggs deposited are laid (seldom and very sparingly) in the soft, woolly material surrounding the forming nut; but later they are inserted in the kernel just under the inner skin, and occasionally they are deposited somewhat more deeply. In no case has the egg been found in the outer husk.

Eggs are laid singly, but many are placed in a single nut, as high as 40 or more (of the smaller weevil) in imported nuts, and as many as 9 in native nuts. The larvæ when hatched feed on the tissue of the growing kernels, enlarging with their own growth the cells thus made. When, as is usual, several larvæ inhabit the same nut, the interior is more or less completely hollowed out, and large masses of excrement are left behind (Pl. XXIX).

By the end of September or the first week of October the beetles disappear. At about the same time, when the nuts first fall, the larvæ begin to mature and issue from round orifices which they gnaw through the shell and which vary in diameter from one-sixteenth of an inch, in the case of the smaller species, to one-eighth of an inch in the larger (see fig. 23). By the size of these holes alone it can be readily determined which species is the dominant one in any given locality. Rarely

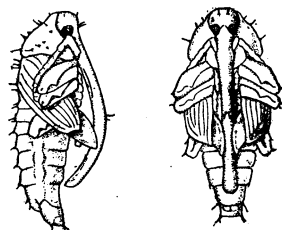


FIG. 22.—Lesser chestnut weevil (*Balaninus rectus*): pupa, from side, at left; ventral view at right—enlarged (original).

larvæ bore through the burr. On leaving the nuts they burrow into the earth to depths varying from 2 to about 8 inches, according to the hardness of the soil. If confined in soft earth or sand they penetrate still deeper. The larval period probably lasts from three to five weeks in the nuts, and about ten months in the earth, pupation taking place within three weeks of the issuance of the beetle, the latter remaining several days in the earth before appearing above ground.

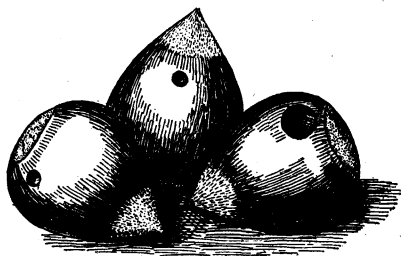


FIG. 23.—Chinquapins, showing injury by lesser chestnut weevil at left; of larger weevil at right—enlarged (original).

The beetles do not fly readily, but cling tightly to their resting place or drop when disturbed; yet, as their bodies are not heavy and their wings strong, they are obviously able to cover considerable distances, especially with the wind. Ordinarily, however, they are sluggish,

like most other weevils, and probably do not go far from the vicinity of the trees which have sheltered them as larvæ, although they undoubtedly migrate when food is scarce.

#### NATURAL ENEMIES.

A natural enemy of the nut weevils is known, a small four-winged wasplike fly, the Braconid parasite *Urosigalphus armatus* Ashm., which develops in the body of the larva.<sup>a</sup>

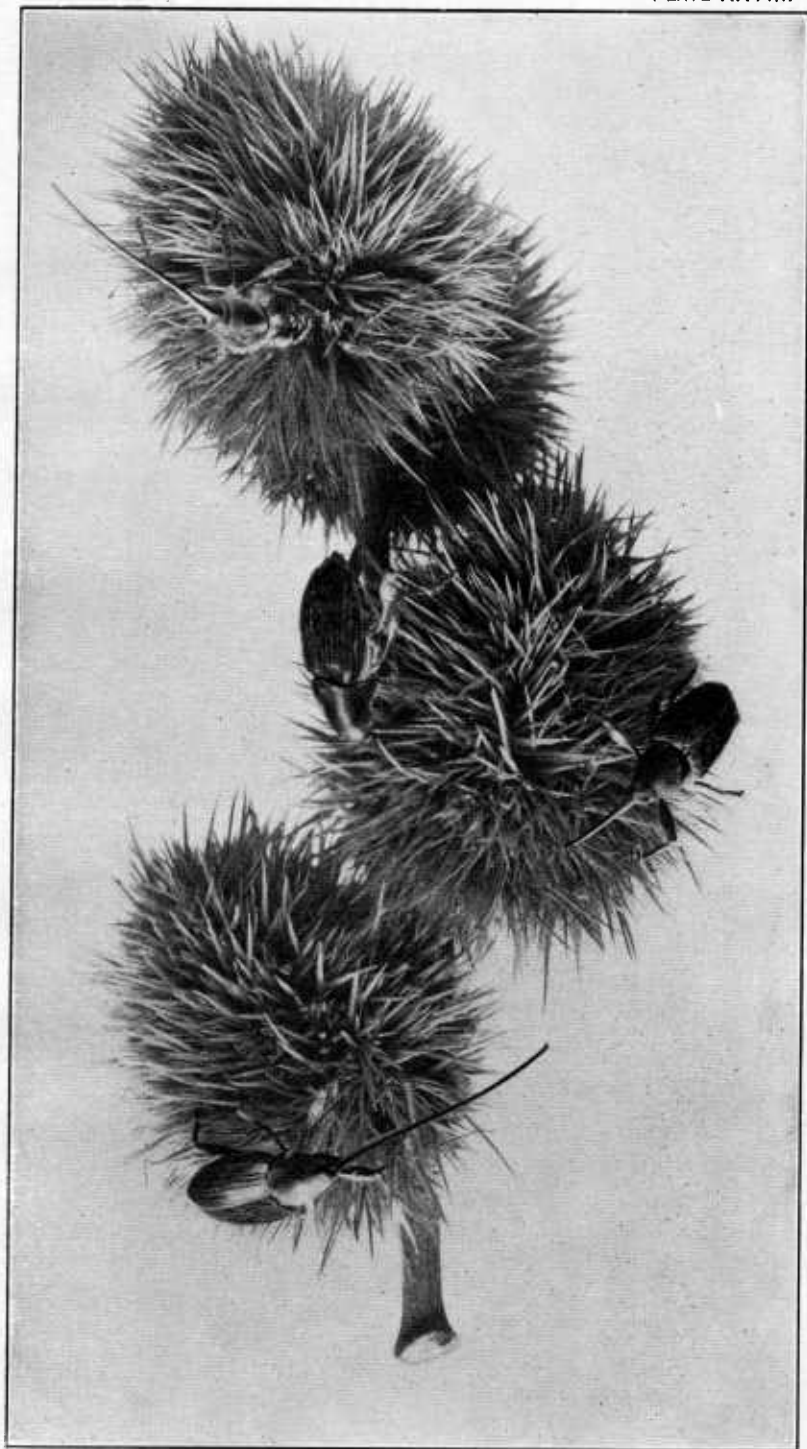
#### METHODS OF CONTROL.

The most practical remedy for nut weevils that can be suggested is the early destruction of the "worms" in the nuts by means of bisulphid of carbon and the observance of clean orchard management and other cultural methods. It may be well to preface the discussion of these methods with a statement of the uselessness against nut weevils of ordinary measures employed in the control of similar insects.

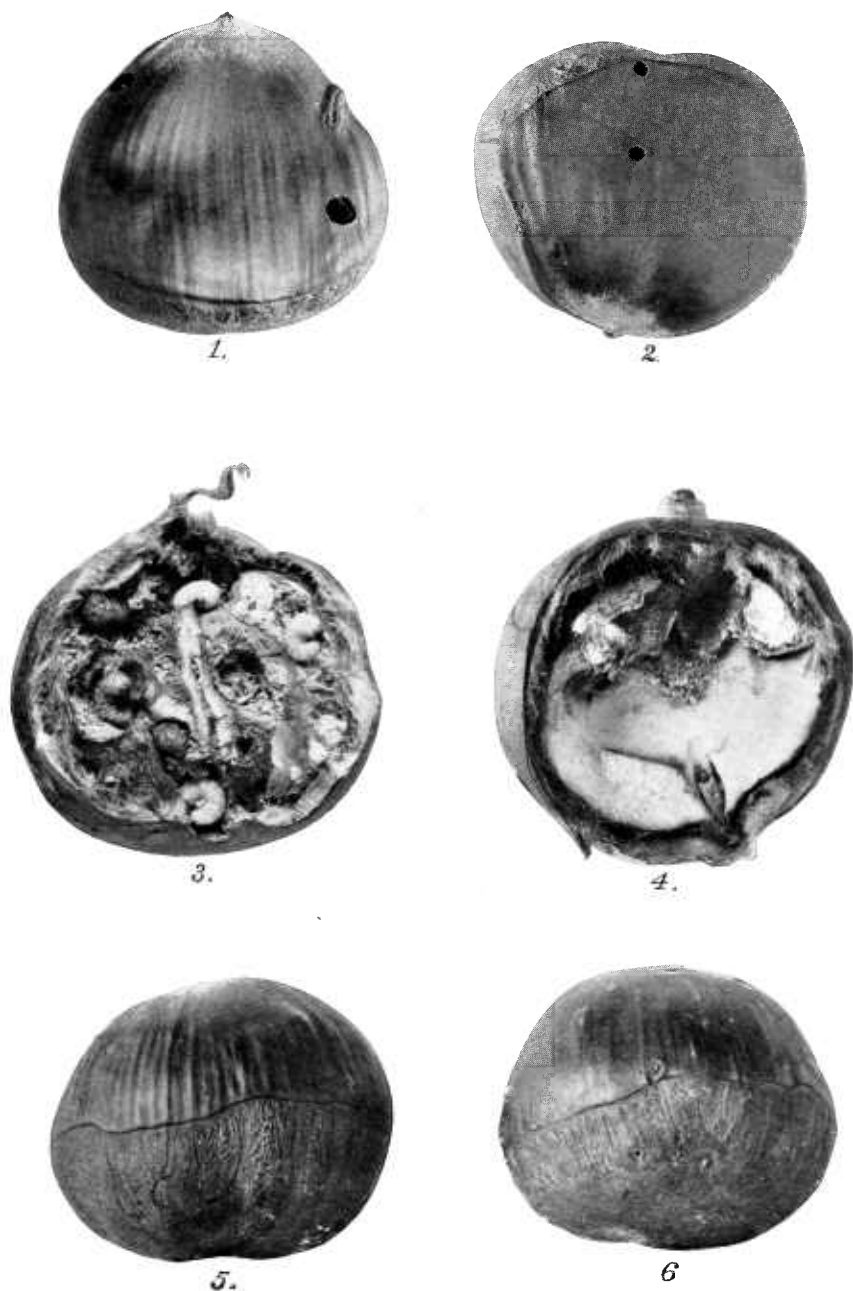
#### UNSATISFACTORY METHODS.

**STOMACH POISONS.**—The peculiar structure, in the nut weevils, of the mouth-parts (minute mandibles placed at the end of a beak nearly as fine as horsehair and as long or longer than the body) is almost sufficient proof in itself that these insects do not feed on leaves, but depend for sustenance on the substance of the growing nuts. The beetles first appearing feed on the undeveloped, very young nuts and the juices within the husk. There is, therefore, no seeming possibility of reaching them with a spray of Paris green or other stomach poison,

<sup>a</sup>Two other insects are associated with the weevils and are probably also their enemies, a Proctotrypid parasite, *Trichasis rufipes* Ashm., and a predatory Reduviid bug, *Acholla multispinosa* DeG.



LARGER CHESTNUT WEEVIL ON CHINQUAPIN BURRS.  
[Twice natural size. Original.]



IMPORTED NUTS SHOWING DIFFERENT FORMS OF INJURY BY NUT WEEVILS.

FIG. 1.—Parry's Giant nut, showing exit hole of *Balaninus proboscideus*. FIG. 2.—Same of *B. rectus*. FIG. 3.—Interior Paragon nut, showing larvæ of *B. rectus* in situ. FIG. 4.—Same, showing work of one individual of *B. proboscideus*. FIG. 5.—Reverse side of figure 2, showing scars made by puncture of female *B. rectus* in ovipositing. FIG. 6.—Reverse of figure 1, with puncture of *B. proboscideus*.—All natural size (original).



particularly as we are unable to place the insecticide where they would eat enough to kill them.

**TRAP CROPS.**—The cultivation of special varieties of nuts with a view to securing immunity from attack or as a means of luring the insects from the main crop does not offer any degree of promise. The Paragon, Cooper, and Ridgeley varieties, according to Mr. G. H. Powell, of the Bureau of Plant Industry, suffer greater loss from weevil attack than Japanese varieties. Chinquapins are favored by the smaller weevil and suffer far more damage, as a rule, than wild chestnuts. It is possible that the planting of the varieties specified, or, better, of chinquapins, at intervals around, as also through, orchards of the least affected varieties might lessen the loss to the main crop. If a variety could be produced which would mature fruit before the advent of the beetles in greatest numbers, this would partially solve the problem, particularly as the earliest nuts bring the highest prices. The nuts gathered toward the end of the season are comparatively uninjured, but by this time the market value is considerably lower.

**CONTACT POISONS.**—Scarcely more can be expected from the use of contact poisons, such as kerosene emulsion, since in view of the long period spent by these weevils in the adult stage (from June and July to September or October) such frequent application would be necessary that the expense would destroy the profit.

**JARRING THE TREES,** as practiced against the plum curculio, is for the same and other reasons equally impracticable, save, perhaps, on young trees grown in a small way.

**THE WATER TEST OF INFESTATION.**—Having doubts of the efficacy of this old-fashioned test of the difference between “wormy” and healthy nuts, an experiment was made by the writer with native chestnuts obtained from a street vender. To begin, 40 per cent were obviously “wormy,” and only 60 per cent apparently sound.

*Results of water test with native chestnuts.*

Nuts which rose to surface.		Nuts which remained on bottom.	
	<i>Per cent.</i>		<i>Per cent.</i>
Uninfested .....	10	In perfect condition.....	40
Showing minute marks only; good flavor; salable.....	20	Slightly injured.....	30
Containing full-grown grubs.....	10	Badly infested.....	20
Containing immature grubs.....	60	Completely filled with grubs.....	10

As will be seen from this experiment, noticeably wormy nuts, as evidenced by loss of weight and the exit holes of the “worms,” naturally rise when placed in water, but the remaining nuts may or may not be infested, and hence require further test than whether they will sink or float.

## DIRECT REMEDIES.

**BISULPHID OF CARBON.**—The value of bisulphid of carbon as a fumigant for chestnuts infested by weevils is now fully established. Although at first thought it would seem difficult for the gas to penetrate through shells so firm and compact and kill the larvæ, nevertheless a prominent grower in Pennsylvania successfully uses the bisulphid, applying it when the nuts are first harvested. The dead weevil larvæ are at this time so small that the average person would never detect their presence, while if they were permitted to develop they would soon destroy the nut for food. Bisulphid of carbon has been used on the largest chestnuts grown in this country, and, since a score or two of larvæ find shelter in a single nut, one can appreciate the desirability of prompt fumigation. The grower mentioned uses bisulphid of carbon at the rate of 1 ounce to a bushel of Paragon nuts placed in a kerosene barrel of about 50 gallons capacity and covered by sacking. After an exposure of about sixteen hours the nuts are removed, the larvæ being then practically all destroyed. Several hundred pounds were treated in 1904 in this manner with perfectly satisfactory results. To verify reported results, Mr. Pratt was detailed to visit the infested orchard and witness the process. This method could be employed at less expense by using tightly fitting covers, the effectiveness of the fumigation being in exact proportion to the tightness of the receptacle and the length of exposure to the fumes. Therefore, a longer exposure of one or two days, with perhaps one-half ounce of bisulphid, should accomplish the same purpose.

**SCALDING AND DRYING.**—Some growers make a practice of plunging the nuts as gathered into boiling water just long enough to kill the contained insects and yet not injure the nuts for sale, after which they are dried before being marketed. This may be profitably accomplished by using a large sieve, which is filled with nuts, dipped in the water, and removed in about five minutes. The late W. P. Corsa used a washtub, in which was placed a bushel or so of nuts, pouring in enough boiling water to come an inch or two above the nuts. Then, by stirring vigorously with a stick, the bulk of the weevily nuts would come to the surface in the same manner as do peas and beans affected by weevils.<sup>a</sup> The infested nuts are skimmed off and destroyed, or they may with profit and safety be fed to hogs, provided the animals do not have a too exclusive diet of this form of food. Salt water, it is claimed, is preferable for scalding, the brine serving to keep the shell soft and pliable and rendering the kernels more palatable than when not thus treated.

Different methods are employed in drying. A good way is to place the nuts in the sun and agitate them occasionally by stirring or

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<sup>a</sup> Note the writer's observations on this head on p. 305.

shaking in a bag until thoroughly dry, because if moisture remains unevaporated it is apt to form mildew when the nuts are prematurely packed for shipment.

Nuts for planting should not be scalded, and care should be taken not to cook the kernels of nuts intended for sale. Some growers claim that the hot-water treatment is objectionable because the nutshells lose a certain degree of polish, rendering them less desirable for market.

HEAT.—Infested nuts can be subjected to a temperature of between 125° F. and 150° F. without injuring them for food or for seed, and this will effect the destruction of the larvæ within. Some growers of chestnuts destroy the weevils by kiln-drying.

COLD STORAGE.—Cold storage has been employed and is successful in arresting the development of the larvæ. The appearance of the nuts is scarcely different from that of those not so stored, but nuts thus treated and submitted to the writer after becoming dry were deficient in flavor, having an acrid and moldy taste.

A crude form of cold storage has been successfully followed by a Virginia grower. It consists in placing nuts in the earth under the shade afforded by his house, where the soil temperature, after the nuts are gathered, does not exceed 50°. Since most insects are inactive below 51° this has the effect of restraining their development, causing the eggs or minute larvæ to die.

#### PREVENTIVES.

CHOICE OF LOCATION FOR THE ORCHARD.—The selection for the planting or grafting of chestnuts of a locality with reference to the chances of immunity from injury by nut weevils is a matter of great importance. For this reason it is most undesirable to plant in the immediate vicinity of woodland abounding in wild chestnut and chin quapin, since these trees furnish natural breeding places for the insects, and are, therefore, a constant menace to successful chestnut culture. Too frequently growers suffer losses from weevils because they neglect to gather the wild chestnuts or chinquapins in the immediate vicinity of their cultivated groves. Another phase of bad management which is frequently practiced is the grafting of cultivated varieties on native chestnuts growing in rocky and uneven soil, often on hill-sides, as shown in Plate XXX, figure 1. In such places it is impossible to harvest a complete crop, and, what is of equal importance, to gather the remnants. Hence, to secure these results, it is imperative to plant or graft trees on smooth ground (Pl. XXX, fig. 2), first for the sake of economy, and second to permit the collection of all of the nuts, leaving none for the propagation of weevils. It is also necessary to keep the soil clean of herbage, as shown at the left of figure 2, Plate XXX, not overgrown with brush, as illustrated at the right.

**CAREFUL HARVESTING.**—It is always advisable to gather the entire crop, leaving none on the ground, and either place the nuts in tight receptacles or fumigate with bisulphid of carbon before marketing. The grubs crawl out soon after the nuts have been gathered, and as they require considerable moisture they will die if confined in closed barrels or boxes. The trouble is that enough nuts are usually left in orchards or in adjoining wood or forest land to serve for the propagation of the insects the following year. In order to make the method of treatment here described thorough, it will be necessary to secure the cooperation of neighboring landowners who grow chestnuts for market and of all who own woodland containing chestnut and chinquapin.

The collection of remnants can be made by children or the unemployed. It is also profitable to allow hogs the run of the orchards to destroy what nuts remain after the crop has been harvested. In the mountainous sections of Virginia and Pennsylvania it is a common practice to fatten swine on the unpicked fallen nuts. Hogs fatten on nuts and acorns as well as on corn, and without expense to the grower.

**COOPERATION.**—The results of the observance of clean farming on the lines that have been indicated may not at once be apparent, but in course of time, if this work is systematically carried out by all growers over a considerable territory, infestation will be very materially decreased. An important point is to ascertain how far the insects fly. Their structure indicates that they are strong fliers and capable, with favoring winds, of migrating considerable distances; but under ordinary circumstances they probably do not fly many miles at a time or in a given year.

#### THE PECAN WEEVIL.

(*Balaninus caryæ* Horn.)

With the increase of pecan culture in our southern States frequent inquiry is made in regard to the cause of the holes in the nuts

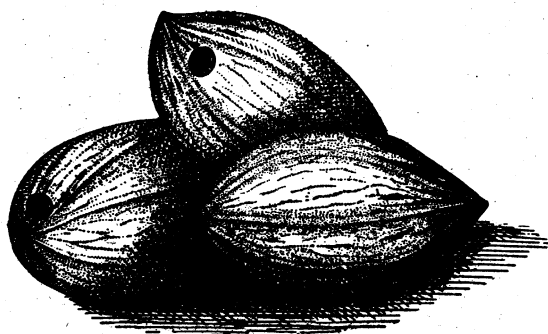


FIG. 24.—Pecan nuts showing exit hole of pecan weevil larvæ—  
one-third enlarged (author's illustration).

(fig. 24), and during 1903 and 1904 there were reports of great injury of this nature, more particularly to pecans grown in Texas, where considerable loss was reported, and in Georgia, where in one locality 75 per cent of the crop was a failure.

A shortage has also been reported in Mississippi. The insect involved in these cases is the pecan or hickory-nut weevil, a pest which is evidently destined to become one of the



FIG. 1.—PARAGON CHESTNUT ORCHARD, GROWING ON HILLSIDES, SHOWING IMPOSSIBILITY OF CLEAN ORCHARD MANAGEMENT.

[From photograph by E. G. Reist.]



FIG. 2.—PARAGON CHESTNUT GROWING ON PLANE SURFACE, WHERE CLEAN METHODS OF CULTIVATION CAN BE PRACTICED.

[From photograph by E. G. Reist.]

principal drawbacks to the cultivation of the pecan. Indeed, in many parts of the South it already divides that distinction with the husk-worm, so that it has been truthfully said that what the husk-worm leaves the weevil destroys.

The beetle (fig. 25) is about the same size as the larger chestnut weevil, from which it may be distinguished by its much duller color<sup>a</sup> and by the relative lengths of the first and second antennal joints, the first joint being longer than the second in the pecan-infesting species.

The larva differs from that of *proboscideus* in being decidedly yellow, having the head bright red and wider than long. Its cervical plate also is darker. The pupa is similar to that of the larger chestnut weevil.

The distribution extends from New York to the Gulf, and westward at least to Iowa.

The life history of this weevil, as it occurs in the pecan in the South, is, so far as can be gathered from reports from Georgia and Texas and from laboratory experiments, very similar to that of the chestnut weevils. According to the observations of Mr. H. A. Halbert, at Coleman, Tex., the female begins to deposit her eggs in August while the pecan is still immature, and the larva usually escapes from the nuts in the latter part of September and in October; but most of them do not issue until the husks open, allowing the nuts to fall. In Georgia they have been found in the nuts as late as the middle of January.

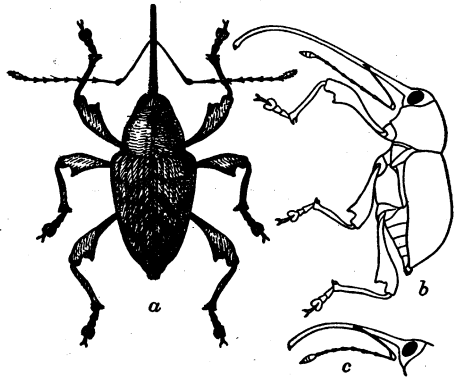


FIG. 25.—Pecan weevil (*Balaninus caryæ*): a, female, dorsal view; b, same, lateral view, in outline; c, head with rostrum and antenna of male—about two and one-half times natural size (author's illustration).

#### REMEDIES.

The same care in the selection of the site for a pecan orchard is advised as in the case of chestnut culture, with this difference, that the grower should avoid planting in the vicinity of wild pecan and hickory of whatever kind. The entire crop, also, should be harvested or hogs should be turned in to devour what nuts are left. At Thomasville, Ga., Mr. Wilmon Newell observed in 1904 that where swine and chickens had had access to a pecan grove, the ground was well rooted and scratched up and there was less loss from weevils than in the pre-

<sup>a</sup>The ground color is uniform dark brown, nearly black, and the scaly covering (which characterizes the chestnut weevils) in this species is hair-like on the thorax, fine and somewhat sparse on the wing-covers, and much duller, with little or no mottling. Moreover, the beak of the female is, comparatively, a little shorter, although of about the same curvature, and is less widened at the base.

vious year. Evidently both hogs and poultry devour the larvæ in the ground.

At the time that bisulphid of carbon was first suggested as a remedy for chestnut "worms" it was feared that the firm and compact shell would hardly permit the gas to penetrate and kill the contained larvæ. Experience, however, has shown that this remedy is successful in the case of chestnuts, and it is not impossible that it might be adapted to pecans, using a larger amount of the chemical and a longer exposure in a perfectly tight receptacle. We can as yet scarcely advise this method on a large scale, but it should certainly be tried experimentally.

### THE HAZELNUT WEEVIL.

(*Balaninus obtusus* Blanch.)

Hazelnuts or filberts are injured in much the same manner as are chestnuts and pecans and by a similar weevil. Injury was recognized as early as 1841, but was attributed to other species than that under consideration. Owing to the comparatively slight importance of the hazel as a nut tree in this country, few notices of losses from weevil attack have been recorded. The weevil which affects the nut was not differentiated from others of its kind until 1884. In 1891 it was reported as badly damaging hazelnuts in Iowa.

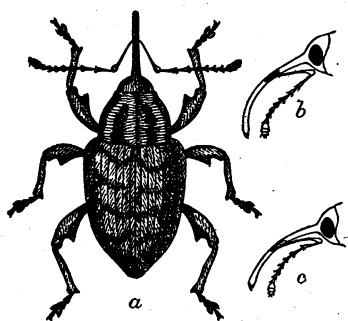


FIG. 26.—Hazelnut weevil (*Balaninus obtusus*), adult: a, female, dorsal view; b, head from side; c, head of male from side—enlarged (original).

The beetle (fig. 26) differs from others which attack edible nuts, exclusive of acorns, by its shorter, more robust form and shorter beak.<sup>a</sup> It is about one-fourth of an inch in length, and the beak does not exceed half the length of the body. The vestiture varies from gray to ochreous, and the elytra are moderately mottled.

This species occurs from Massachusetts and New Hampshire, westward to Minnesota and Texas. Injury has been noted in Massachusetts, New York, Indiana, Iowa, and Minnesota.

Of the life history little has been recorded beyond the fact that the "worm" issues from the side of the nut, and that paired adults have been found on hazelnuts in July.

### REMEDIES.

Since hazels are not cultivated in this country to any extent, no remedy need be employed other than gathering entire crops and destroying isolated bushes where it is unprofitable to gather the nuts. It would be quite possible, owing to the small size of the hazel plant, to control this species by jarring, as for the plum curculio.

<sup>a</sup> The appendices of the claws are broadly rectangular, and the femora or thighs are armed with large teeth. The scape of the antenna in the female is long.